

A HISTORY OF INFANT FEEDING

PART IV—NINETEENTH CENTURY CONTINUED

BY

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Social Conditions in the Nineteenth Century

The awakening of the social conscience, which had received such a great impetus from the observations and activities of Coram and Hanway in the preceding century, continued to progress and flourish during the nineteenth century with consequent benefit to the care of infants in general and to their feeding in particular. There was ample room for improvement, however, as Thomas Bull pointed out when he compared and contrasted the appalling social conditions in Liverpool with healthy Lewisham, which was in those days a prosperous and fashionable suburb. After Hanway's time various suggestions had been made to raise the standard of infant care amongst the poor, and William Buchan had remarked that 'if it were made the general interest of the poor to keep their children alive we should lose very few of them'. He proposed the payment of a small yearly premium to each poor family for every child alive—a foreshadowing of present-day family allowances.

The condition of infants in the workhouses steadily improved so that by 1842 the Guardians were encouraged to allow a nursing mother to have access to her child at all times except when at work, and in 1895 the Local Government Board insisted on the provision of a separate nursery for children under school age which should be dry, suitably furnished and well ventilated. Furthermore, the infants were to receive regular medical inspection.

The general well-being of infants outside the workhouses likewise improved and the value of infant life increased. Nevertheless during the year 1870 no less than 270 dead infants were found in the streets, and in the same year the Infant Life Protection Society was founded (Craig, 1946), followed two years later by an Act of Parliament which considerably tightened up the regulations with respect to infants under the age of 1 kept for gain. This Act was inspired by the Select Committee's Report to the House of Commons in 1871 on baby farming, which still resulted in a mortality of 60%.

Apart from Armstrong's Dispensary for the Infant Poor, which unfortunately closed in 1781, very little medical attention was available for slum babies in the early part of the century until John Bunnell Davis founded the Universal Dispensary of Blackfriars in 1816 under the patronage of the Duke of Kent. Later the St. Marylebone Dispensary opened (1834) with a charge of one half-penny per week for all children under the age of 14. Later still the voluntary hospitals developed an increasing interest in paediatrics and other voluntary bodies were formed, such as the Ladies' Sanitary Reform Association which was primarily interested in reducing the incidence of summer diarrhoea.

The two main obstacles to progress in this direction were the general ignorance of slum mothers with regard to hygiene and the correct methods of artificial feeding, and the appalling lack of standards of cleanliness for cow's milk, particularly in the towns. In London, in the middle of the century, cows were kept in a truly disgusting condition in crowded, ill-ventilated, underground hovels where their food and dung were inadequately separated and disease was rampant. Furthermore, in order to bolster up the naturally very poor yield, the milk was watered and chalk was frequently added. Even as late as 1895 an analysis of 30 samples of milk from working class areas in London revealed that 24 were 'sophisticated', either by removal of the cream to a level below 3%, or by dilution, or by the addition of boric acid as a preservative (*British Medical Journal*, 1895, 2, 150), and these tests of course took no account of the bacterial content of the samples. The water supply was also liable to be heavily contaminated and this was no doubt responsible for many infant deaths, but the situation improved when all the companies were amalgamated with the formation of the Metropolitan Water Board in 1902. A relic of the unsatisfactory state of public water is still to be found in all the pamphlets on infant feeding in which the giving of *boiled* water is always recommended though this is now quite unnecessary.

The growth of the public health movement during the century was stimulated by the fear of cholera epidemics and by the appalling conditions in the city slums, so vividly described in an illiterate style in a letter to *The Times* in 1849 (Shryock, 1936). It is unnecessary to enter into further detail of how the prevailing social conditions were gradually improved, but it must be emphasized once again that it is pointless to follow the progress of the history of infant feeding without taking due cognizance of the background with which contemporary workers in the field had to contend.

Infant Mortality

The consequences of good or bad methods of infant feeding, and to a less extent of good or bad social conditions, are clearly reflected in the infant mortality figures which therefore provide a convenient index for the assessment of the whole problem. A full account of all the social, economic, racial, climatic, medical and many other factors which have a bearing on this subject is to be found in an article by Seibert (1940) in which he quotes Dublin (1915) as saying that 'beginning with the second week of life, infant feeding is clearly the chief factor in the mortality'. Hence a brief study of the trends in mortality will be made here.

As we have already seen, the bills of mortality in the seventeenth and eighteenth centuries were grossly inaccurate but with their assistance Shryock (1936) has computed that the average infant mortality in England for the decade 1731-40 was 437 per 1,000 births, falling to 240 for the years 1791-1800, i.e., a reduction approaching 50% corresponding with the period of great philanthropic activity. At the beginning of the nineteenth century Thomas Bull estimated that one infant in five died under the age of 1 (200 per 1,000 births), but by the middle of the century the figure remained stationary about the level of 155 for many years, of which some 47 were neonatal deaths. The figure fluctuated from season to season, being highest in autumn, and also between town and country, but overall progress was slow. The illegitimate mortality rate was about twice as high and Routh (1863) considered that about 93% died in the first three years of life, whereas many others were registered as stillbirths.

By the end of the nineteenth century there was even a slight increase in the infant mortality rate to 163, but thereafter an almost uniform decline up to the present day has taken place. Representative figures for the past 50 years, expressed as points on a curve which smooths out the yearly variations, are approximately as follows:

1900	..	150	per 1,000 live births
1910	..	105	"
1920	..	85	"
1930	..	65	"
1940	..	55	"
1950	..	30	"

The above figures apply to England and Wales, but there have been wide national variations in the same general downward trend. Thus in the year 1948 the figure for Italy was 70 which was approximately the level for New Zealand in 1900, the latter having now been reduced to the record low level of 22. Contrary to expectation, times of national stress, and particularly of blockade, have not necessarily been accompanied by a rise in infant mortality, and this has been attributed to the fact that when food in general is scarce, breast feeding comes into its own. In Paris during the siege of 1870-71, and in Germany during the 1914-18 war, this was so, and it was therefore unfair to accuse the Allies of the murder of innocent babes by blockade tactics. In England in 1940-42, however, a slight rise was recorded, which was perhaps the result of overcrowding in shelters rather than a direct relation to feeding factors.

The importance of the influence of infant feeding regimes on the morbidity and mortality is even more clearly demonstrated when comparative figures for breast and artificial feeding are examined. Routh (1863) quotes the figures obtained from the Children's Hospital, Manchester, where 1,041 attending children were divided into six groups ranging from those fed entirely on the breast for nine months to two years, down to those entirely hand reared. Amongst the former, 62.6% were described as 'well developed' whereas amongst the latter only 10% were so classified. Out of the total number, only 25.3% had been entirely breast fed for six months, though only 4.5% were entirely hand reared which emphasizes the persistence of the earlier custom of giving additional food besides breast milk from birth. Routh also carefully examined the feeding history of 50 consecutive infant deaths in Brighton and found that 10 infants had been entirely breast fed, 25 partly breast fed and 15 entirely hand reared. Of the former, three infants died from pertussis, five from teething and convulsions and two from marasmus. Of the latter, one died from pertussis, two from overfeeding, three from diarrhoea and the remainder from various causes. Routh was of the opinion that 34 out of the 50 deaths were due to overfeeding or injudicious feeding.

The high mortality rate of illegitimate babies is, of course, mainly due to the high incidence of artificial feeding amongst them. In an annotation in the *Lancet* (1878, 2, 341) it was pointed out that 69% of the deaths of hand-reared, legitimate infants,

and 68% of the deaths of hand-reared illegitimate infants were attributable to diarrhoea, whereas for suckled infants the proportions were respectively 45 and 43%, but since 63% of the legitimate group and only 14% of the illegitimate babies were suckled, the much higher mortality of the latter group is accounted for. The relative importance of feeding, even when other social factors are known to be bad, is amply demonstrated.

Summer diarrhoea accounted for about two-thirds of the deaths of all infants and it was therefore the major factor in determining the increased mortality in towns, in autumn, and in artificially fed babies. The mortality rate therefore closely followed the bottle-fed incidence in each community and it is not surprising to find that in Bavaria where, as we have seen, breast feeding was looked upon as almost immoral, the infant mortality figure was exceptionally high and 96% of the fatal cases of diarrhoea were hand fed.

Wet Nurses in the Nineteenth Century

It has already been noted how, in England, the peak popularity of wet nurses was reached towards the end of the eighteenth century and how subsequently their employment slowly but surely declined, so that by 1900 they had become almost extinct. George Armstrong, in the latter half of the eighteenth century, was amongst the first to prefer dry- to wet-nursing but nearly 100 years were to pass before this point of view was generally accepted, during which time the production and elaboration of artificial foods was well under way. Thus by 1863 Routh was able to state that the safety of artificial feeding was sufficient to outweigh the moral disadvantages in the employment of a wet nurse, but the following characteristic passage from the contemporary pen of Anthony Trollope suggests that the aristocracy was not yet converted to the blessings of the bottle:

"Of course Lady Arabella could not suckle the young heir herself. Ladies Arabella never can. They are gifted with the powers of being mothers, but not nursing-mothers. Nature gives them bosoms for show but not for use. So Lady Arabella had a wet-nurse."

Domestic problems must have been frequently aggravated by the sudden invasion of the servants' quarters by a female of doubtful morals who was at once accorded certain privileges which were denied even the oldest family retainers. Routh was strongly averse to 'familiarizing our households with the spectacle of vice rewarded', and he feared lest 'the master, mistress and other servants be tainted by these fallen women'.

Writing about the same time as Routh, however, both Bull and West fully recounted the classical attributes of a good wet nurse, and Graham (1865) devoted no less than 33 pages of his book to the subject. By 1897, however, Edmund Cautley observed that wet nurses were rarely employed in England, although in France and Russia they were still made use of by the State in foundling hospitals. Nevertheless he listed the usual objections to their use mainly on moral grounds, drew attention to their mercenary outlook, warned against their use of opium (sometimes cunningly given by applying the drug to the nipple to escape detection), and advised a careful assessment of their suitability by a thorough medical examination and at least one test feed. Graham had believed that the moral qualities of the nurse were more important than the physical, but this traditional view which had been almost unchallenged for at least three thousand years, was finally disposed of by Cautley: 'The popular notion that mental and moral qualities of the nurse are transmitted through the medium of breast milk is absolutely without foundation.' According to Still (1931) this actual problem was debated at Oxford as early as 1605 but he did not record the result.

With the gradual discarding, in medical circles, of the traditional views during the second half of the nineteenth century, there arose a more scientific interest in the use of wet nurses. There was much speculation about the transmission of syphilis between nurse and infant, and mother and baby (*viz.* Colles' Law), and Günzburg at the Moscow Foundling Hospital recorded that he had under his care 31 healthy women suckling 120 syphilitic babies for a minimum period of six months, yet not one had become infected.

At the Maternité in Paris Budin employed 14 wet nurses who suckled their own infants together with variable numbers of weaklings depending upon the circumstances. At one time the number rose to 50, which meant that each nurse was required to provide about 40 feeds daily, but this proved too arduous a task and it was found that the maximum number of feeds should not exceed 34 daily, for above that figure both babies and nurses suffered. The daily output from each nurse was carefully charted and the average yield from each of seven selected nurses over a period of about four months amounted to about three pints, the maximum almost reaching five pints when the demand was heavy. In fact it was repeatedly observed that the supply varied closely with the demand and that this held good even for nurses who had been lactating continuously for over a year. Budin checked the quality of the nurses' milk carefully but he did not find any

appreciable alteration with prolonged lactation, in contrast to the hitherto widely held view that if a wet nurse is to be employed the age of her milk should closely correspond with the age of the infant to be suckled. Even such an eminent physician as Cheadle had subscribed to this idea.

During the twentieth century, even on the continent, the use of wet nurses has diminished almost to vanishing point, largely for social reasons, for the supremacy of breast milk is still fully recognized. Indeed, to satisfy the demand in the changed social circumstances, some centres have set up breast milk banks where expressed breast milk from several women is pooled and pasteurized before distribution. The first was opened in Boston in 1910 and the first in London was at Queen Charlotte's Hospital since when several have been instituted all over Europe (Mackintosh, 1947).

The Evolution of Feeding Bottles and Teats

Feeding bottles are known to have been in use since the earliest historical times and very many Roman examples in various shapes and sizes have been found. These vessels were at one time thought to be oil cruses but their frequent discovery in the graves of infants led to their correct interpretation. The Roman civilization was by no means the only ancient one to use them, for specimens have been found in France which are believed to date back to B.C. 2000 (Lacaille, 1950), and numerous examples were found at Jebel Moya in the Nile Basin by the Wellcome Research team dated approximately B.C. 500 (Addison, 1949), including a cup with a long spout found in the grave of twins less than 3 months old.

In the Middle Ages the use of perforated cow's horns was probably widespread amongst the peasants and there is evidence that this form of vessel was still in use in the eighteenth century. vide Armstrong's description of 1767 (p. 158):

'The horn made use of for suckling is a small polished cow's horn which will hold about a gill and a half. The small end of it is perforated, and has a notch round it, to which are fastened two small bits of parchment, shaped like the tip of the finger of a glove, and sewed together in such a manner, as that the food poured into the horn can be sucked through between the stitches. This appears to be a very simple and ingenious contrivance, and is admired by some, who look upon it as a kind of artificial nipple: and it might very well be considered as such, if we had but the breast milk to convey through it. Or if we could discover any food of the same thinness with the milk, and as nourishing as it is, the horn might still answer. But as a discovery of this kind is not to be expected, and the food which the child sucks through this artificial nipple must be thin, there requires a large quantity of it to

nourish the child, and hence its stomach and bowels are too much relaxed, whereby it is in danger of falling into the watery gripes.'

For this reason, Armstrong himself preferred the boat or spoon. The danger of watery gripes was, of course, dependent upon the unhygienic nature of the vessel; the above passage provides a characteristic example of the confusion which has existed, and still exists, between the dangers of overfeeding and injudicious feeding. Similar, though perhaps more potent, dangers were inherent in the 'sucking bag' which was in widespread use in Germany at this time. Struve has provided us with this robust description of it (1801, p. 271):

'One of the most disgusting customs is the sucking bag which is given to a child for the double purpose of nourishing and composing it. Many a poor mother will tear a rag from an old shirt or a clout which she has found perhaps in the street and which may contain the remains of a venereal contagion: of this she makes a small bag, which is filled with bread, milk and sugar and then given to the child to suck. If the infant happens to drop this rag on the ground it is presented again covered with dirt: a number of flies settle upon it when the child is alone which but the moment before may have quitted a saucer of poison.'

The elaboration of feeding bottles took place in the eighteenth century with the fabrication of boat-shaped vessels made of china, and with the invention of Hugh Smith's famous pewter 'bubby-pot' in 1770. His own description from Letter IX of the 1792 edition reads as follows:

'I have contrived a milk pot for my own nursery . . . it appears to my family and to many of my patients preferable to those now in use and may probably be still further improved . . . This pot is somewhat in form like an urn, it contains a little more than a quarter of a pint: its handle and spout or neck are not unlike those of a coffee-pot except that the neck of this arises from the very bottom of the pot and is very small. The end of the spout is a little raised and forms a roundish knob somewhat in appearance like a small heart: this is perforated by three or four small holes: a piece of rag is tied loosely over it which serves the child to play with instead of the nipple, and through which, by the infant's sucking, milk is constantly strained. The child is equally satisfied with it as with the breast: it never wets him in the least: he is obliged to labour for every drop he receives: . . . and greatly in recommendation of this contrivance the nurses confess it is more convenient than a boat, and that it saves a deal of trouble in the feeding of an infant: which is the greatest security for the parents that servants will use it when they themselves are not present.'

It was not until the nineteenth century that glass bottles were first in use, and it was during that century that the modern feeding bottle was evolved

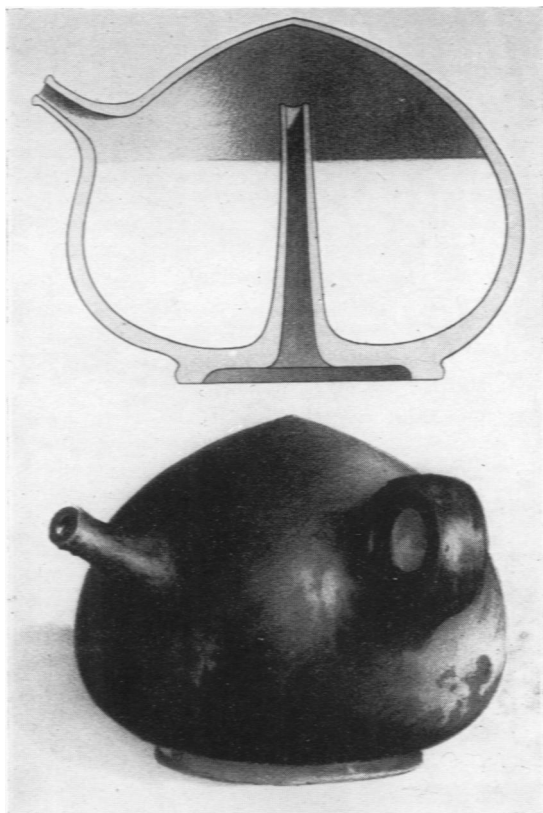


FIG. 8.—Ancient infant's feeding bottle.
Reproduced from S. H. Sadler's *Infant Feeding by Artificial Means*
by kind permission of Messrs. G. Routledge and Kegan Paul Ltd.



FIG. 9.—Hugh Smith's 'bubby-pot', 1770.
A photograph from a specimen in the Wellcome Historical Medical
Museum, reproduced by kind permission of the Director.

(Maw's made their first in 1830). At first these bottles tended to be over-elaborate, for example the 'biberon' which was imported from France in the year of the Great Exhibition (1851) and which was made of glass with a cork nipple and spiral air inlet with ivory pins to regulate the flow. Later Routh devised a pear-shaped vessel which could be

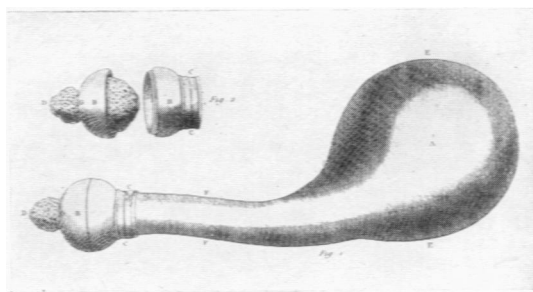


FIG. 10.—Baby feeder described by F. Baldini, 1784.
Reproduced from *History of Paediatrics* by Still with the kind permis-
sion of the Oxford University Press.

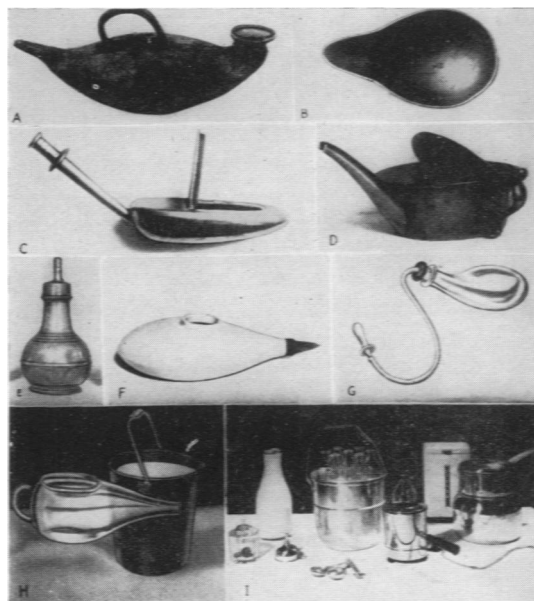


FIG. 11.—Evolution of the nursing bottle.
A. Roman baby-feeder: made of clay, before A.D. 500. B. Pewter
pap-boat, eighteenth century. C. Pewter pap-boat, covered. D.
Pewter feeding pot, 1790. E. Pewter feeding bottle with metal nipple.
F. Feeding bottle with chamois nipple, 1830. G. Bottle with long
siphon tube, 1876. H. Nursing bottle and container, 1886.
I. Modern equipment.

Reproduced by kind permission of Dr. Arnold Gesell from Figure 11
in his book *Feeding Behavior of Infants*.

strapped to the mother's chest called a 'mamma'.

Curiously enough, in France at this time spoon feeding, or direct suckling from animals, were more in vogue as an alternative to a wet nurse than the use of the bottle. There is a note in the *Lancet* of 1894 to the effect that a directive had recently been circularized there to the medical inspector of baby farms banning the use of metal feeding bottles and those provided with tubes. In addition nurses were forbidden to give solid food to infants under the age of 1 unless they could obtain a medical certificate to sanction it.

In England, the bottle with the long siphon tube was popular for many years, and in 1895 they were still in regular use in the workhouses (*Brit. med. J.*, 1895, 2, 159), no doubt because the infant could obtain milk from them quite easily without a nurse having to hold each child separately. The medical profession, however, appreciated the danger of the long tube, and Mrs. Sadler recommended in 1896 that the tube and teat should be kept permanently in Condyl's fluid between feeds. The simplest form of feeding bottle, of the plain 'soxhlet' type, thereafter became more and more popular but it has the disadvantage that the baby sucks against a vacuum which the open-ended, boat-shaped bottle overcomes. This can, however, be also overcome by using a teat with a side valve through which air can enter the bottle.

In the eighteenth century teats were made of linen or sponge and the fluid was sucked through the stitch holes. Teats made from chamois leather or prepared heifer's teats were gradually introduced during the early part of the nineteenth century, and in 1848 Bull mentioned both types of teat for use with a graduated glass bottle, but if obtainable he preferred one made with cork. Heifer's teats were preserved in spirit and used until putrefaction set in; Forsyth (1910) mentioned that they had been in use within living memory. Rubber teats were first introduced in 1856 (Drummond *et al.*, 1940) but at first they were often too unyielding and were unpopular because of their 'repulsive taste and smell' (Forsyth), so that we may conclude that their universal adoption did not take place until well into the twentieth century. In spite of the general acceptance of the rubber teat, it should be clearly appreciated that it is a very poor imitation of the human nipple. Holes at the apex are either so small that the infant swallows air in his efforts to get milk or so big that the flow of milk fills his mouth and threatens to choke him while he is swallowing. To overcome these difficulties, Witkin (1939) has suggested the use of a knob-shaped teat with a cruciate incision over the apex one-eighth of an inch long, which can be enlarged if necessary. In this way a free flow is delivered only when the child sucks. Fredeer (1948) has abandoned the use of the rubber teat altogether and instead recommends and practises cup feeding from birth for all artificially fed infants, thus avoiding later weaning difficulties.

Artificial Milks and Patent Foods

Before the nineteenth century the only alternatives to breast milk were either animal milks used with or without modifications or else some form of

starchy concoction made with bread or flour. The first step towards the production of dehydrated milks was made by Newton in 1835 (Drummond *et al.*, 1940) who patented a process for slowly concentrating sweetened cow's milk into a 'honey-like mass' which kept 'fairly well' in pots. In 1847 Grimsdale took out a patent for evaporated milk made with the use of steam-jacketed pans in a partial vacuum, and sold in wax-capped bottles. In 1855 he succeeded in drying milk but he had difficulty in eliminating thermostable organisms, and in preventing sedimentation on reconstitution. Nevertheless Routh (1863) had high hopes of Grimsdale's 'patent desiccated milk'. Nestlé's produced the first condensed milk in 'tin boxes' in 1866, and later several more firms manufactured similar products though the less reputable ones used skimmed milk bought cheaply from the butter factories. It was found that sweetened condensed milk kept better than the unsweetened.

The roller process for drying milk was first instituted on a large scale by the Swedish butter factories (Pritchard, 1916), and later unskimmed milk was treated in the same way. Shortly afterwards the spray-drying process was used in France, with the advantage that the shortened period of heating reduced the size of the insoluble sediment. By 1902 both spray- and roller-dried milks were becoming increasingly widely used and their popularity is now firmly established. This rapid development has been a mixed blessing, for now over a dozen firms each produce a bewildering number of formulae based upon variations in the fat, protein and carbohydrate content; one in particular now produces no less than 20 different dried milk formulae (exclusive of other starchy milk foods and complicated sugar preparations) made, in many cases, to the specifications of leading paediatricians! One of the good things which came out of World War II was the need for economy and simplicity, and in consequence the Government-sponsored, roller-dried National Dried Milk was made available to the public at subsidized prices. At first only a full cream variety was produced but later a half-cream preparation was also found to be needed. In England today roller-dried milks are most commonly used, with spray-dried and evaporated products far behind, but in America the reverse is true.

Parallel with the evolution of dried milks ran the development of numerous patent infant foods. Professor von Liebig, the famous chemist who laid the foundations of our knowledge of proteins and the value of nitrogenous foods, devised a formula in 1863 for the perfect infant food consisting of

cow's milk, flour, potassium bicarbonate and malt which sold for 6d. a quart (Drummond, p. 447). It was, however, never well received, and Chambers (1876) wrote of it: 'sensible parents will be content to leave the recipe for some coming race who may prefer art to nature'. Later numerous farinaceous foods became available such as Boaden's (made from barley and wheat flour), Prince of Wales' Food (potato flour), and Plumbe's (pea, bean and potato flour). Later still malted cereals came on to the market (e.g. Mellin's and Horlicks) in which the starch is completely hydrolysed, and Savory and Moore's in which hydrolysis is only partial. By 1883 there were no less than 27 brands of patent infant foods available, and it is not surprising that doctors and parents alike were confused about the particular compositions and relative merits of these products, nor was it appreciated that they were all, to a greater or less extent, unsuitable for babies under 6 months of age. Yet Cautley (1897) recalled an infant under 3 months old who had been tried on 14 different proprietary foods already because of failure to thrive.

It was unfortunately not appreciated that vitamin supplements are required if condensed milks and starchy foods are used as the sole food for infants and this led to a rise in the incidence of scurvy and

rickets comparable to that which had occurred at the beginning of the seventeenth century. As we shall see in the next part, this rise in incidence stimulated medical thinkers, especially Gee, Cheadle and Barlow, just as Whistler and Glisson had been stimulated over 200 years previously. The situation was not improved by the fact that, in the popular view, starchy foods were 'light' (whatever that may mean), and the advertisements carried pictures of fat, flabby babies as the ideal to be attained while the wording accompanying them immorally implied that each particular brand was superior to all other foods for infants, including, by implication, breast milk.

In recent years the search for artificial substitutes for milk has been animated by the desire to produce a food suitable for allergic infants (Brodrigg, 1944), but in some parts of America synthetic milk, which was introduced by Gerstenberger in 1915 made from animal and vegetable fats (Morse, 1935), has been used in recent years for feeding normal babies. From time to time the potentialities of soya bean flour have been investigated, recently revived in the interests of national economy (Mackay, 1940), but interest today is directed more towards the encouragement of natural methods of feeding rather than to the production of synthetic masterpieces.